INCIDENCE OF FUNGAL FOOT
INFECTIONS IN DIABETES,
"LEPROSY AND PERIPHERAL VASCULAR
DISEASES"

THESIS

For

MASTER OF SURGERY

(.GENERAL SURGERY)





BUNDELKHAND UNIVERSITY, JHANSI (U. P.)

This is to certify that the candidate or. Kamal Numar Sharma has put in the necessary stay in the department of Surgery as per university regulations.

Dated:

1988.

(S. L. Agarwal)

1. J., F. R. C. S.

Professor and Head,

Department of Surgery.

Department of Surgery, M.L.B. Medical College, Jhansi.

This is to certify that the work entitled " INCIDENCE OF FUNGAL FOOT INFECTIONS IN DIABETES, LEPROSY AFO FERIPHERAL VASCULAR DISEASE " which is being submitted as a thesis for H.S. (Gen. Surgery) examination of Bundelkhand University 1989 by DR. KAMAL KUMAR SHARMA, has been carried under my guidance and supervision. The techniques and statistical method used, were undertaken by the candidate himself and were checked periodically.

(Dinesh Aratap

Lecturer,

Department of Surgery. H.L.B. Medical College, Jhansi.

Deted:

1988.

This is to certify that the work entitled "INCIDENCE OF GEUNGAL FOOT INFECTIONS IN DIABETES, LEPROSY AND PERIPHERAL VASCULAR DISEASE" which is being submitted as a thesis for M.S. (Gen. Surgery) examination of Bundelkhand University 1989 by DR. KAMAL KUMAR SHARMA has been carried out under my guidance and supervision. The techniques and statistical methods used, were under taken by the candidate himself and were periodically examined.

Dated:

1988.

(P. K. Singh)

M.D.

Deptt. of Skin VD & Leprosy

M.L.B. Medical College,

Jhansi

American Commission of Security

28.X1.58

(D. C. Govil)

M.D., D. VD.

Reader

Deptt. of Skin VD & Leprosy

M.L.B. Medical College,

Jhansi.

This is to certify that the work entitled " INCIDENCE OF FUNGAL FOOT INFECTIONS IN DIABETES LEPROSY AND PERIPHERAL VASCULAR DISEASE " which is being submitted as a thesis for M.S. (Gen. Surgery) examination of Eundelkhand University 1989 by DR. KAMAL KUMAR SHARMA has been carried out under my guidance and supervision. The techniques and statistical methods used, were under taken by the candidate himself and were periodically examined.

Dated: .

1988.

(Navneet Agarwal)

Lecturer Deptt. of Medicine M.L.B. Medical College: Jhanai.

(Ratna Saxena)

M.D.

Lecturer

Deptt. of Pathology M.L.B. Medical College,

Jhansi.

ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

sincere thanks to my esteemed teacher and guide Dr. Dinesh Tatap, M.S. Lecturer in the department of Surgery for his keen interest, guidance and invaluable help, in every way at every juncture of this project. His inspiration fostered me greatly throughout this humble venture, without it would have not been possible to complete this work.

My profound gratitude and indebtedness is due to Professor S.L. Agarwal M.S., F.R.C.S., Head of the department of Surgery (Gen. Surgery) for his valuable suggestion, encouragement and sympathetic attitude throughout the course of this study, which has been an unfailing source of inspiration for me.

I am deeply indebted to my reverd teacher Dr. Navneet Agarwal, M.D., Lecturer in Medicine, Dr. Hatna Saxena, M.D., Lecturer in Pathology for their excellent guidance, constant supervision and constructive critisism from time to time which proved very helpful for the successful completion of this work.

I extand my sincere thanks to Dr.Dinesh Govil, M.D., Resder in Skin VD & Leprology and Dr.P.K.Singh, M.D., Lecturer in Skin VD & Leprology for their immense help and extreme co-operation in the study of this subject.

Take this opportunity in acknowleding my deepest gratitude to all my teachers of the department Dr.S.P.Atri, M.S., F.R.C.S., Dr. R.P.Kela, M.S., Dr.Mohan Singh, M.S., Dr. Rajeev Sinha, H.S. and Dr.Uday Aumar Jain M.S., for their keen interest and valuable help at all occasions.

Finally I bestow my thesis to my wife Dr UPMA, my sweet daughter 'Chintu', my parents, and my friend Dr. Arun Chaubey who have been a great source of encouragement and inspiration in the successful completion of this work.

Last but not the least my thanks are due to Mr. Jwele Singh, Lab. Tech., for devoting his so much time in Laboratory work, Mr. Bishan (Librarian) for his immense help in providing me concerned Literature and Mr. B.F.Tiwari for devoting so much time in typing the manuscript neatly and faultlessly.

Datedi

(KAMAP KUMAN SHARDA)

CONTENTS

| | | | | PAGE NO. | | |
|----|------------------------|-------|-----|-------------|----|--|
| 1. | Introduction | * * * | • | • · · | 3 | |
| 2. | Material & Method | | 4 | -395 | 9 | |
| 3. | Review of Literature. | | io | | 19 | |
| 4. | Observations | | ವಿಂ | 600 | 36 | |
| 5. | Discussion | • • • | 27 | 1998 | 30 | |
| 6. | Summary & Conclusion . | | 31 | 182 | 33 | |
| 7. | Bibliography | 7 | 4 | 1045 | 37 | |

INTRODUCTION

The frequency of foot involvement in patients diabetes peripheral vascular disease and leprosy is well recognized. The most serious complication in the feet of diabetes and peripheral vascular disease patients can be the gangreen of foot and resultant leg amputations. Mooney et al have reported that over 80% of the lower extrimity amputations are the result of vascular disease and 50-70% of these amputations are smong diabetics. Among leprosy patients, its the trophic ulceration that frequent.

According to the study of Meade and Muceller there three basic anatomic type of major foot infections in diabetes:

- (1) Abscess occurring in the deep spaces of foot in the central space.
- (11) Non suppurative phlegmens of the dorsum of the foot.
- (iii) Infection of the malperforant neurotrophic ulcer of planter surgace of the foot.

It is well known that any disease process destroying the integrity of skin surface will permit invasion by micro-organism. Anaesthetic feet are much more

prone to repeated trauma and breach in the skin. In case of feet with poor vascular supply the wound healing is delayed and chances of invasion by bacteria into deeper tissue are thus high. This happens in leprosy, diabetes mallitus and peripheral vascular disease.

Fungal infection of feet especially toe webs are not uncommon, these are at times associated with secondary staphylococcal cellulitis occuring as a compulication these fungal infections are said to cause a breach in the skin surface and through this breach secondary infections occure.

Not many studies have been done to study the frequency of fungal infections in the feet.

In a study by Fitzpatrick T.B. et al (1960), it was observed that interdigital dermatophytosis predisposed to bacterial infection because the resultant epidermal fissures and erosions create portal of entry for pyogenic cocci leading to cellulitis and infectious gangreen of foot.

In veiw of the above, it is apparent that superficial fungal infections can lead to severe type of bacterial infections of feet. Yet frequency of fungal infection of feet is not much known among patients suffering with diabetes mallitus leprosy or peripheral vascular disease.

So our study therefore aims for demonstrating the occurance of fungi in feet of patients of diabetes leprosy and peripheral vascular disease. This can help in early prevention of bacterial infection among them or better pedicure.

AIMS OF THE STUDY

In the present study we tried to find:

- (i) Insidence of fungal foot infections in diabetics.
- (ii) Incidence of fungal foot infections in leprosy patients.
- (iii) Incidence of the same in patients of peripheral vascular diseases.
- (iv) A comparison of above patients with normal persons (control), would be done.

MATERIAL AND METHOD

The present study was carried out in the department of Surgery, N. L.B. Medical College, Jhansi in active collaboration with the department of medicine, department of Pathology and department of Skin and V.D. Over a period of 5th Nov. 1987 upto 10th Oct., 1988. The case material for the present study was obtained from the out patient clinics and indoor wards of the concerned department of M.L.B. Medical College, Jhansi. The study comprized of 108 cases out of which 20 served as control.

The whole study group was classified into two broad groups.

I. <u>CONTROL GROUP</u> - This group comprised of the patients those who were not having either of these three diseases.

II. <u>DISEASE GROUP</u> - Patients suffering from diabetes.

leprosy or PVD were studied under this group.

Clinical history for age, sex, religion occupation socio-economic status was taken. Detailed information about the type of foot wear used by the patient, habbit of smoking and duration of illness was collected.

In peripheral vascular disease patients complaints suggestive of intermittant claudication, rest pain, cold extrimities, raynaud's phenomenon, foot ulcers, migratory thrombophleibitis were noted. In the patients of diabetics complaints suggestive of polyures, polyphasia, polydyspea, weight loss were recorded. Similarly in Leprosy patients, the complaints of nodular erraptions, hypopigmented patches, deformities of toes, Loss of sensation, itching, maceration, fissuring and cracking of sole, Errythmatus patches, numberess tingling, blisters, were recorded.

A detailed history about the type and duration of treatment and any corticosteroid and antifungal treatment one month prior to the study was noted.

(A) Clinical Examination

A detailed clinical examination regarding peripheral vessels, peripheral nerves, foot sensations and presence or abscence of gangrane over foot, was done.

Foot skin was examined in detail for texture, color, hairs, nails local temperature, oedema, toe tip.

Investigation

Routine investigation for blood and urine in every patient was done, disease specific investigation

as slit smear for AFB and skin biopsy in leprosy.

fasting and post parandial blood sugar in diabeties
was done. Toe web scrapping and culture was done in
every patients.

Collection of specimens

In all cases specimen were collected from the toe webs. The two webs were washed with savelon solution followed by local cleanising with cotton wool and 70 percent alcohal. When dry, the skin scraps were taken with a sterile scalpel and the material was collected in sterile folded paper.

Culture

- Media Sabouraud's dextrese Agar (SDA)
- Composition of media Glucose 40 gm

Peptone 10 gm

Agar 20 gm

Water 1 litre

The low pH and high sugar content of the media was made them particularly selective for fungi and inhibitory to bacteria. The agar medium was used for primary isolation of fungi from clinical material. Chloramphenical (40 mg/litre suspended in 10 ml of 95 percent alcohal) was added to the media for the selective growth of fungi.

Ingredients were dissolved in steamer and were filtered through cotton gauze and were adjusted pH 5.4, dispensed in stock bottles. It was autoclaved at 115°c for 15 mt.

Inoculation of specimen

The specimen were inoculated into sabouraud's dextrose agar (SDA) slops. The inoculation was made with hooked nickle chromic wire (SWG 18) on the solid medium and the inocula were pressed into the surface. The metal caps of the bottles left loose and incubation was done at 26°c.

Examination of the culture

the growth. Identification depends partly on colonial appearance which change slowly with time but principally on the morphology of the spores which are most clearly seen soon after they first develop. Culture were therefore examined every day for the first week and thereafter every 2-3 days. They were discarded as negative. If there was not visible growth after 3 weeks. If a contaminant appeared anywhere on the slant, material from the size of original innoculation was transfered to a fresh tube at ence and with all care. If two different colonies appeared at the size of innoculation, each was transfered to a fresh tube.

Collonies were identified according to their size, shape surface, texture growth, any cotten wool appearance and any pigment production.

Identification of Isolates

Smears were prepared and gram staining was done for identification. Positive slides were again stained by modified AFB. Superficial dermatophytes were identified by colony characteristic and microscopical examination.

Some of the characteristic features have been mentioned below --

Three different typesof pathological dermatophytes were identified. Their features are described as follows -

1. Tricophyton rubrum

- The colony is valvety.
- white or reddish in colour.
- Pigment is cherry red and usually first appear at a dry margin.

M/E- Microconidia are elongated.

- Macroconidia are typical of the genus, long and narrow but may not be produced except on rich media.

2. Trichopyton mentagrophytes

- The colony type vary
- Strains are pinkish buff with a granular surface and large number of spores.

- M/2- Dicroconidia are abundant, spherical and found in clusters along the sides of hyphae.
 - Trichophyton type macroconidia are produced in moderate numbers with in 5-10 days and are upto 50 um long with 3-4 septa.
 - Straim differ from T. rubrum in producing a urease and being able to panetrate fregments of hair in artificial culture.

3. Epidermophyton floccosum

The colony appears first as a white +aft and them spreads out as a flat grey downery growth becoming greenish yellow and powdery as macroconidia are produced. Later central folding and radial furrows develop and at any stage white tufts of 'Sterile' mycelium may appear on the surface and overgrow the whole colony.

M/E -Microconidia are never produced.

- -Macroconidia are typically smooth and pear shaped 30-40 um in length and with upto 4 septs.
- -There is only one species in the gemus epidermophyton infects the skin of the groin (dhobie's itch) and the toes and occasionally toe nails but never hair.

REVIEW OF LITERATURE

Factors associated with development of the foot lesions in the diabetics.

Types of foot lesions in diabetics

There can be three types of foot lesions

in diabetes

- 1. Septic lesions
- 2. Ulcers &
- 3. Ischaemic lesion as stated by Theodore et al 1963.

Septic lesion comprised of any significant sepsis in the feet including cellulitis infected ulcers or planter abscesses.

Ischaemic lesions include gangrene rest pain or thretened gangrene.

Fathogenesis of foot lesions

factor in cases of gangrene & infection. Other conditions influencing in the development of the lesions are infections, arteriosclerosis, neuropathy & diabetes itself.

- 1. Trauma This includes injury from all causes i.e.
- (a) Mechanical pressure or friction
 Callessities or corn

 Vesicles from tight shoes

 Injury from direct trauma

- (b) Thermal burns due to hot soaks, hot water bottles & electric pads, cold as in freezing.
- (c) Chemical strong antiseptics & adhesive tape.

2. Infections

non diabetic in relation to infection even when diabetes is well controlled. The diabetic is more susceptible to infections, localized to it with more deficulty and is prone to deep extension. This may be due to malfunction of the leukocytes, which has been shown with decreased phagocytosis and a decreased diapedesis (Howard et al 1973). Hyperglycaemia has been shown to interfere with leukocyte functions and migration of leukocytes Drachaman et al (1966), Ainsworth and Allison (1970) & Bagdade et al (1970).

There is some disagreement as to whether diabetes increase susceptibility to staphylococcal dermatological infections, but there is uniform aggrement that once the infection has started it is more severe in diabetic patients Normland 1958, Former (1960) & Williams (1960). Although results of various investigations are contradictory, there is no clear evidence of a defect in antibody synthesis or plasma bactericidal substantances. Bybee & Rogers (1964) have found polymorphonuclear leukocytes from acidotic diabetic patients defective in capacity

to phagocytize the bacteria. Dubas (1953) has suggested that in acidosis, intracellular antibacterial substances may not be effective.

Susceptibility for fungel infections

cutaneous mycotic infections candidiasis and mucormycosis. The influence of acute diabetic acidosis produced by alloxan on experimental mucor infections have been extensively studied by Sheldon & Bauer (1960). They found a striking dissemination of subcutaneous mucor infections only during the period of acute acidosis & it was due to delay in leukocyte mobilization. This delay was corelated with the failure of mass cells to degramulate. Scholer (1963) suggested that the diabetic patients may lack a protective protein. Which is normally present in all individuals. This substance appeared to be a small protein & being inactive against fungi. Other than candida albicans.

3. Arteriosclerosis

The role of arteriosclerosis in the diabetic patients is fairly obvious in relation to arterial insufficiency and gangrene. The vascular degenerative changes occur at a earlier age in a diabetics as compared to non diabetics. The disease is more widespread in the diabetics and more commonly involves the smaller more distal vessels. In such a patient infection may result in serious gangrene (Pratt et al 1950).

4. The diabetes itself

It is generally accepted that the successful surgical treatment of the diabetic depends upon good control cof the diabetes.

5. Neuropathy

Catterall et al (1972) have supposed the role of neuropathy. The somatic neuropathy has a profound effect on the
foot. There is weakness & wasing of the intrensic muscles
of foot. All this leads to foot deformity & abnormal weight
distribution over the metatarsal heads. The presence of
autonomic neuropathy may reduce the response to injury
since the histamine induced triple response is reduced
Strokes et al (1975) & Faris (1975).

6. Microangiopathy

The microangiopathy in skeletal muscles a skin, menifested by endothelial proliferation and basement membrane thicking in the arterioles & capillaries are now considered as contributory factors for the foot lesions as studied by Goldnberg et al (1959). Moore et al 1965 & Pederson (1962).

7. Altered carbohydrate metabolism of the skin in diabetes

Urbach (1940) proposed a condition of "skin diabetes" responsible for increesed susceptibility of dispetics for infections.

FOOT LESIONS IN LEPROSY

Next to the hands feet suffer most from

4. The diabetes itself

It is generally accepted that the successful surgical treatment of the diabetic depends upon good control cof the diabetes.

5. Neuropathy

Catterall et al (1972) have supposed the role of neuropathy. The somatic neuropathy has a profound effect on the
foot. There is weakness & wasing of the intrensic muscles
of foot. All this leads to foot deformity & abnormal weight
distribution over the metatarsal heads. The presence of
autonomic neuropathy may reduce the response to injury
since the histamine induced triple response is reduced
Strokes et al (1975) & Faris (1975).

6. Microangiopathy

The microangiopathy in skeletal muscles a skin, menifested by endothelial proliferation and basement membrane thicking in the arterioles & capillaries are now considered as contributory factors for the foot lesions as studied by Goldnberg et al (1959). Moore et al 1965 & Pederson (1962).

7. Altered carbohydrate metabolism of the skin in diabetes

Urbach (1940) proposed a condition of "skin diabetes" responsible for increased susceptibility of diabetics for infections.

FOOT LESIONS IN LEPROSY

Next to the hands feet suffer most from

disabilities in leprosy patients. The deformities and disabilition of the feet arise, as in the hand, from specific, paralytic and anaesthetic causes.

- 1. Specific deformities of the feet are more uncommon than those of the hands. In these cases the feet show changes similar to those seen in the hands resulting in 'reaction foot', or 'twisted toes' or 'intrinstic plus toes'.
- 2. Paralytic deformities resulting from damage to the major nerve trunks of the leg and foot and consequent paralysis of the intrinsic and extrinsic muscles of the foot are quite common. Claw toes result from paralysis of the intrinsic muscles and paralysis of extrinsic muscles gives rise to drop foot.
- 3. Anaesthetic deformities Neuropathic planter ulceration and disorganization of the foot are important consiquencies of walking on anaesthetic feet.

Planter ulcers in leprosy patients

The planter ulcers in leprosy patients may be due to one of the three causes (1) external injury with subsequent infection (2) infections through cracks and fissures (3) internal injury caused by walking and other activities of the foet.

External injury - like a thorn prick or a penetrating wound by a splinter, glass piece or a protruding nail in the foot wear is neglected even if noticed. It is still neglected due to absence of pain which is readily infected leading to abscess formation.

Infection - Infective organism enter through fine crackes in the corn and collosities or through deep fissures that are sometimes seen in the dry inelastic and brittle soles of these patients. The bursa like loose areolar tissue deep to the corns and callosities and relatively avascular subcutaneous fat form ready foci for lodgement of infection and its spread which culminates in suppuration and ulcer formation. External injuries and infection through crackes and fissures are important causes of ulcer formation although only a small preportion of ulcers arises from these causes becauses ulcer from these causes can be effectively pre-

Internal injury - ulcer starts as an internal necrosis, and skin ruptures late.

Peripheral vascular diseases

Peripheral vascular disease includes a variety of conditions affecting the peripheral blood vessels.

Classification

- A. Occlusive arterial diseases
 - 1. Arteriosclerosis obliterans
 - 2. Simple arterial thrombosis

- 3. Arterial embolism
- 4. Compression at the cervicobrachial junction.

B. Other vascular conditions

- 1. Raynaud's disease
- 2. Acroscleroderma (Acrosclerosis)
- 3. Livedo Reticulosis
- 4. Erythromelagia
- 5. Pernie
- 6. Ergotiam
- 7. Acute thrombophlebitis of large veins
- 8. Venous insufficiency.
- 1) Thromboansitis obliterans (Euerser's disease) is a disease of unknown origin occuring predominately in young and middle aged men. Often heavy smokers. Burges L (1924) and Von winiwester (1879). Experimental work has shown that cestrogen hormone prevents ergotamine induced sangrene in rats (McGrath 1955). Winrath et al (1940) has demonstrated that nicotine causes vasoconstriction and occulusion.

Foot lesions in Buerger's disease

Symptoms - Include pain, a sensation of coldness and abnormal sensitivity to cold temperatures. Intermitent claudications is the most common and often the earliest complication. It is produced by exercise, relieved by rest

and accentuated by edd and always occurs distal to the point of occulusion, typically in the arch of the foot and occasionally in the calf.

Rest pain - Consists of a severe gnawing ache in the toes, usually appearing after an acute occulusion and remaining severe for days or weeks. It is caused by ischaemia of tissues including the sensory nervel terminals. Because it is often a prelude to ulceration or gangrene frequently it is termed pretrophic pain.

Coldness and sensitivity to cold the toes and foot are subjectively cold & numb.

- Signs Objective findings pertain to identifible arterial occulusion and the effects of circulatory insufficiency.
- 1. Impaired arterial pulsation the dorsalis pedis and the post tibial pulsations are reduced or absent in a majority of patients. It is important to remember that the dorsals pedis is normally absent in 8% cases.
- 2. Colour changes with posture change.
- 3. Temperature changes Asymmetrical coldness is palpable, the temperature may vary from toe to toe.
- 4. <u>Ulceration and gangrene</u> ulceration occurs with severe arterial insufficiency. This may develop spontaneously or may follow mechanical, chemical or tehermal trauma. A small

ulcermation commonly appears about the nail margins.

Gangrene is commonly dry and involves one digit, less
often the foot. Cellulitis and apreading infections are
uncommon.

- 5. Oedema This may be caused by thrombophlebitis and ischaemic necrosis of small digital vessels.
- 6. Trophic changes Nails are thick and deformed and digits are shrunken. Skin gets atrophied.
- 7. Superficial thrombophlebitis this is nodular and migratory. It occurs in 40% of patients and lasts from 1 to 3 weeks. Thrombophlebitis when seen in association with occulusive.

Role of funsal foot infections in causation of foot lesions in diabetes, leprosy and peripheral vasculars diseases --

<u>Webspace funses infection</u> - Epidermophytosis a common fungal infection is frequently found between toes. It is oten responsible for breaks in the skin with secondary infection followed by gangrene (Theodore et al 1951).

Inder digital dermatophytosis is major factor predisponsing to infections because of the resultant epidermal fissures and errosions create portals of entery for the pyogenic cocei-leading to callulitis and infectious gangrene of the digits (Fitzpatrick et al (960).

Role of amoking in etiposthogenesis of foot lesions

Smoking has always been considered a factor in the etiology of foot lesions not only because of the increased incidence of athermoma, but also because of the added shift to the left of the oxyhaemoglobin dissociation curve due to glycosylation (L. Delbrige et al 1982 & Thomas M. 1981).

Role of footwears in causation of foot lesions in Diabetes Laprosy and Peripheral vascular disease

Because of the custom of wearing shoes and the necessary for weight bearing, the local conditions on the surface of the feet lead to retention of skin products eap. water the amount of fatty acids secreted by sebaceous glands is less & the low fatty acids concentration may predispase to ringwarm infections (Rothman et al 1949). Because the feet are cool, moist and usually less clean than the hands dermatephyte and atypical mycobacterial infection are common even in non diabetics. In the diabetic patients, even minor trauma leads directly to stasis and ulceration, followed by penetration of pathogenic skin fungus & bacteria and ultimately by overt infection.

OBSERVATIONS

Present study includes 108 cases out of which 88 patients were from various disease groups and 20 served as control.

Table I Number of cases studied

| 51.10. | 5 tudy (88) | group % | Con | trol (20) | roup | |
|-------------|-----------------------|---------|-----|-----------|------|--|
| 1. Diabetes | 30 | 34.09 | | | | |
| 2. Leprosy | 38 | 43.18 | | 20 | | |
| 3. 1 VD | 50 | 22.72 | | | | |
| Total | 88 | | | | | |

As shown in table I, There were 88 patients in study group among which 30 were diabetics, 38 patients were from leprosy and 20 patients of peripheral vascular disease. 20 persons served as control.

Table II
Age/Sex distribution

| Age | group | Total No. of Cases | Male | % | Fenale | % |
|-------|-------|-----------------------|------|-------|--------|-------|
| 0 - | 25 | 24 | 19 | 79,16 | 5 | 20.83 |
| 25 - | 50 | 43 | 27 | 62.79 | 16 | 37.20 |
| 7 | 50 | 21 | 16 | 76.19 | 5 | 23.80 |
| Total | | 88 | 62 | | 26 | |

It is evident from the above table that in the group of 0-25, there were 24 patients out of which 19 (79.16) were male. In 25-50 Age group, number of patients were 43 among whom 27 (62.79) were male similarly in 750 age group 16 were male out of 21. The male to female ratio in the study was 2.5:1.

Table III

Incidence of the fungal infection in foot in different categories.

| | Total No. of patients | No. of posi | tive | %s | |
|----------|--------------------------|-------------|------|------|--|
| Diabetes | 30 | 12 | | 40 | |
| Leprosy | 38 | 10 | | 26.3 | |
| FVD | 20 | 6 | | 30 | |
| Controls | 20 | 4 | | 20 | |
| Total | 88 | 28 | | 31.8 | |

This is clear from the above table that in diabetics, the incidence of infection was 40% (12/30). In leprosy incidence was 26.5% (10/38). In PVD this was 30% (6/20). In controls, incidence of infection was 20% (4/10). The overall incidence was 31.8%.

Table IV

Correlation of fungal infection of foot with duration of illness.

| Duration of illness | Diabetes (30) | | | Leprosy (38) | | | PVD (20) | | |
|---------------------|------------------|-------------|---------|-----------------|----|-----|----------------|----------|--|
| | No.of | +Ve Case | % 36 | No.of | | | No.of Cases | * | |
| Upto 5 years | 21 | 7 | 33.33% | 30 | 6 | 20% | 17 | 6 35.29% | |
| More than 5 year | °s 9 | 5 | 55.56% | 8 | 4 | 50% | 3 | NTJ NTJ | |
| Total | 30 | 12 | | 38 | 10 | | 20 | 6 | |

In our present study we found that patients having systemic disease for more than 5 years have more incidence of fungal infections of foot as compared to group of less than five years of history. However in peripheral vascular disease group of more than 5 years of history had no positive case.

Table V
Age, Sex correlation with fungal infection of foot.

| | Total N | Q. 76 | Male | | | Female | | | |
|---------------|---------|-------|------|-------------|-------|----------------|--------------|------|--|
| | Veses | | | +Ve Case | 26 | No.of Cases | +Ve Cases | | |
| 0-25 (24) | 5 | 20.83 | 19 | 4 | 21.05 | 5 | 1 | 20 | |
| 25=50 (43) | 18 | 41.86 | 27 | 12 | 44.45 | 16 | 6 | 37.5 | |
| 750 | | | | | | | | | |
| (21) | 5 | 23.80 | 16 | 4 | 25 | 5 | 1 | 20 | |
| Total | 28 | | 62 | 20 | | 26 | 8 | | |

In this correlation, we have seen that incidence was more in males as compared to females in the ratio of 2.5:1.

Correlation of fungal infection of foot with type of use/non use of foot wear.

| Disease | (Cha | pot wear | Closed | No foot wear | | | |
|----------|----------------|----------|----------------|--------------|-----|----------|-------|
| | No.of Cases | % | No.of cases | % | No. | At anger | % |
| Diabetes | 17 | 7(41.17) | 19 | 5(41,66) | 1 | N13 | (N11) |
| Leprosy | 30 | 7(23.33) | 7 | 3(42.85) | 1 | NII | (N11) |
| PVD | 12 | 4(33.34) | 6 | 2(33.34) | 2 | N11 | (N11) |
| Total | 59 | 18 | 25 | 10 | 4 | | |

In the group who did not use foot wear at all had zero incidence though the number of patients in this group disease was very little (total 4) where as among those who used foot wear, wearing closed foot wear favoured fungal infection. It was 40% Vs 30% and this difference was more or less there in each group.

In the control group, all the patients used foot wear.

Table VII

Correlation of the type of fungus present with different categories.

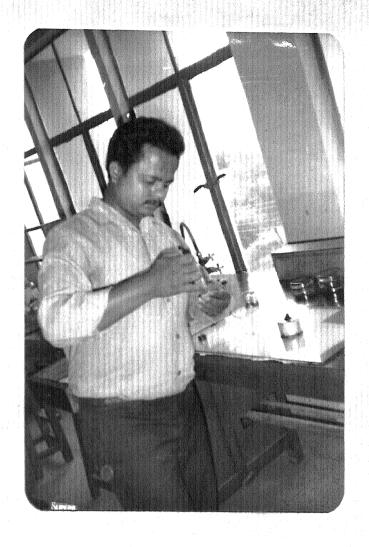
| Group | Type of fungue | | | | | | | | |
|-----------------|-------------------------|-------|-----------------------|--------------|-----------------------|-------|--|--|--|
| | Tricon | hyton | Em. | Idermophyton | Micorporem | | | | |
| | No. of + ve Cases | | No.of +Ve Cases | % | No.of +ve cases | | | | |
| Diabetes (12) | 8 | 66.67 | 1 | 8.3 | 3 | 25 | | | |
| Leprosy (10) | 6 | 60.0 | 1 | 10 | 3 | 30 | | | |
| (6) | 4, | 66.67 | 1 | 16.67 | | 16.67 | | | |
| Control (4) | 2 | 50.0 | 1 | 25 | 1 | 25 | | | |

As the table indicates, the incidence of Tricophyton group of infections was meximum among all the groups of various diseases as well as controls.

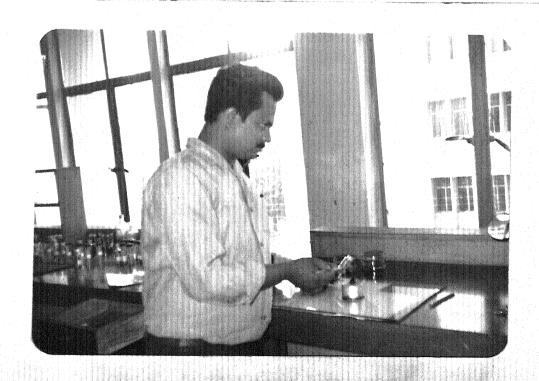


Photograph No. 1 & 2: Showing the collection of foot scrapings for fungal culture.

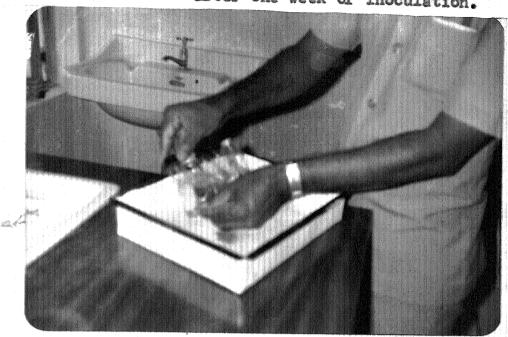




Photograph No. 3 & 4: Showing the inoculation of the foot scrapings into the culture media.

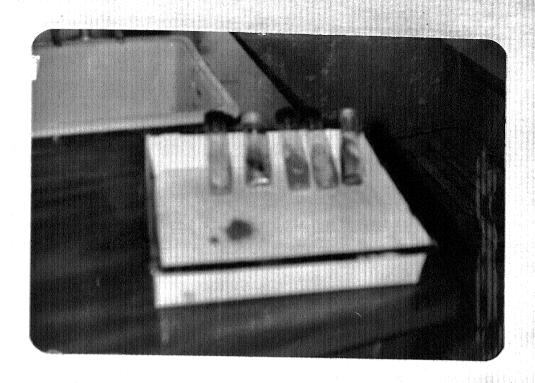


Photograph No. 5: Showing the growth on the culture media after one week of inoculation.



Photograph No. 6: Showing the growth on the culture media after two weeks of inoculation.





Photograph No. 7: Showing the growth on the culture media after three weeks of inoculation.



Photograph No. 8: Showing the staining of the slide smear prepared from the growth on culture media.

Hillandin

DISCUSSION

The present study was carried out in the department of Surgery with active collaboration of department of Medicine, Skin & VD and department of pathology.

Incidence of fungal foot infection

A. General population (Control)

In this series the incidence of asymptomatic fungal feet infection was 20% in general population (control gases). Incidence of fungal feet infection in general population reported by various authors are -

Smith et al (1961) - 18.6%

Pankajalakshmi et al (1980) - 15.2%

Mailbach et al (1965) - 18.6%

In this way our findings of asymptomatic fungal foot infections in general population are more or less same with other series.

B. <u>Diabetes</u>

In the present study, asymptomatic fungal foot infection was found in 40% cases of diabetes. Among the 30 cases of diabetes females were conspicously few (30%) as compared to them males. This is possibly due to less

incidence of diabetes among the females and mostly because less exposure of females to collecties and trauma. In a study on foot lesions in diabeties by Krahitish et al (1981) also females were less commonly involved i.e. 10% cases compared to males (90%).

difference is not as widely seen as here as reported by Massachuotte et al (1955) & duplesis (1970).

In our study the majority of the patient studied were below the age of 60 years. Kshitish et al (1961) had similar study group. While in the west diabetic foot lesions are more commonly seen beyond the age of 60 years - Ooikley et al (1956), Goldenberg et al (1959) and duplesis et al (1970). This difference is probably due to earlier occurence of peak incidence, decreased longivity and to greater exposure of feet to traums in patients of diabetes in rural India.

In this study, the incidence of asymptomatic fungal foot infection in controlled diabetics were found about 40% while in Greenwood & Rockwook (1929) study of 100 well controlled diabetics, 70% were found to have dermatophytosis of interdigital areas of the feet. While in a separate study by Greenwood (1927) the incidence was

about 40%. He stremed that location of this infection i.e. interdigital spaces, as a starting point for more serious condition. It is remarkable that nearly more than 50% of the cases studied, had asymptomatic fungal foot infection who had systemic illness for more than 5 years.

Foot wear

In our study group tight fitting of shoes and socks had predesposed to higher incidence of fungal infection as compared to use of open foot wear. Similar was the observation of Broughton RH 1955 who found that in addition to providing a permanent reservoir of dermatomphytes with opportunities for reinfection. Socks and shoes provide a confined, warm moist environment which encourages the growth of these pathogens.

We could not get appreciable number of cases of barefoot walkers. However in 4 such cases no case was positive. In another study both closely fitting show and barefoot are found to be prone for fungal foot infections in general population. In our study the difference in barefoot group may be because of lesser no of patients.

It has not been possible for us to come across any literature where attempt has been made to compare the incidence of asymptomatic fungal foot infections in

diabetes, leprosy and peripheral vascular disease cases. As such it has not been possible for us to compare our results with the findings from other cases.

In our study, foot scraping (Web spaces) culture has revealed that in all positive controls and patients from various disease groups, majority of cases were of tricoplhyton followed by epidermophyton and microsporum. In the series conducted by Pankajalaxmi et al (1979), also Tricophyton rabrum was the most common fungus affecting the foot in normal population.

SUMMARY AND CONCLUSION

SURLARY

- 1. The incidence of asymptomatic fungel infections in foot of patients of diabetes, Leprosy and Peripheral vascular diseases was studied in this series and was compared with control group.
- 2. 88 patients comprising of diabetes (30), Leprosy (38) and FVD (20) were included in the study group and 20 controls were studied over a period of one year from Nov. 87 to Oct., 88.
- 5. The diagnosis of above mentioned diseases was made by detailed clinical history, examination and relevant investigations.
- 4. The toe webs were cleaned with savelon solution and 70% alcohal skin scraps were taken with sterile scalpel and material was collected in a sterile paper for culture of various pathogenic fungl.
- 5. Specimens were inoculated into sabouraud's media and innoculated slopes were studied over a period of 21 days for any significant fungal growth.
- 6. The genera and species of the various fungi were identified by characteratics of colonies, Pigment production and by morphology.
- 7. The asymptomatic fungal foot infection in control group was found to be 20%.

- 8. The overall rate of asymptomatic fungal foot infection in patients of diabetes was 40%, Leprosy 26.7% EVO 30%.
- 9. Number of patients in the age group of 25-50 was maximum in study as well as in control groups.
- 10. The percentage of male patients was more in comparison of female patients in the study as well as in control groups.
- 11. The asymptomatic fungal foot infection was more in those patients who had symptoms of illness for more then 5 years except in the patients of peripheral vescular diseases. It might be due to lesser number of patients in this group.
- 12. It was observed in this study that tight fitting of shoes and socks had probably predisposed to higher incidence of fungal infections as compared to use of open foot wear. In control group all patients used foot wear.
- present in the patients of study and control group were Tricophyton, Epidersophyton and sicosporas.

 Among which the incidence of tricophyton was maximum i.e. disbetes (66.67), Leprosy (60.0%) IVD (cc.67%) and 50% in controls.

ON

CONCLUSIONS

resonably conclude that the foot care of patients of leprosy FVD and specially of diabetes should include the prophylactic steps to prevent and fungal growth in the foot by -

- 1. Keeping the foot dry.
- 2. Avoiding moisture.
- 3. Prophylactic treatment with antifungal agents.

where the fungi are the initiating agents for the foot infections by causing microscopic breaches and creating a portal or entry for severe infections which in its ultimate degree can result in loss of limb or foot. It is a well aware fact that once the septic infection is established, though many of such feet can be saved but it requires prolonged treatment in hospital which includes multiple surgery also. Naturally this can all be avoided just by adopting a prophylaxis against fungal foot infections. This subject has been studied in diabetes but whether the same could also determine the state of health of foot in patients of leprosy and peripheral vascular disease or not remains to be explored by many such studies in future.

JM.

BIBLICGRAPHY

The state of the s

BIBLIOGRAPHY

- 1. Arthur M. Greenwood & Etncl M. Rockwood. " The skin in diabetic patients".
 - Archives J. of Dermatology 21, 1930, pp. 96-107.
- 2. Arthur I., Greenwood. "A study of the skin in five hundred cases of diabetes".
 - J.A.M.A. vol. 89, Sept. Cat., 1927.
- 5. Ainsworth 5.A. and Allison F. Jr. "Studies on the pathogenesis of acute inflammation. The influence of hyperosmalority secondary to hyperglycaemia upon the acute inflammatory responses induced by Thermal injury to ear chambers of rabbits.
 - J. Clin. invest. 49, 433, 1970.
- 4. Bagdade J.D., Nielson K.L., Root R. and Bulgir R.

 " How defense in disbetes mellitus: The feckless
 phagocytes during poor control and ketoacidosis.

 J. Diabetes (Supp. I) 19, 364, 1970.
- 5. Suerger L. " The circulatory disturbances of the extremities " Philodelphia W.D. Saunders 1924.
- lower extremities in diabetic & non diabetic person".

 An. J. Clin. Path. 28, 27.
- 7. Sryiogle Y.W. and Bradley R.F. (1957): "Vascular complications of diabetes mellitus". Diabetes 6, 159.

8. Broughton R.H. " Reinfection from Soaks and Shoes in times pedis " Brit. J. Derm. 67, 249: 1955.

A CONTRACT OF THE PARTY OF THE

- 9. Catterall, R.C.F. (1972). " The diabetic foot".
 Brit. J. Hosp. Fied. 7, 224.
- 10.Drachman R.H., Root R.K. and Wood W.B." Studies on the effect of experimental nonhepatic diabetes mellitus.

 On antibecterial defeuse. Demonstration of a defect in phagocytosis. J. Exp. Med. 124, 227, 1966.
- 11. Amplisis D.J. (1970). " Lesions of the feet in patients with disbetes mellitus " South African.

 J. Surg., 8, 129.
- 12.Ferås I.B. " Blood flow in the normal and diabetic foot."
 Aust. M. L. J. Surg. 1975, 45, 425.
- 15. Gorlick F.H. and Kuruvilla, J.T. (1968). "Surgery of the diabetic foot in tropics "in Proc. World Cong. in Diabetes in tropics, Ed. J.C.Patel N.G. Talwalkar Diabetes Association of India p 375.
- 14. Coldenberg S., A lex M., Joshi A.R. and Buementhal T.

 (1959). " Non atheromatous peripheral vascular disease of
 the lower extremities in diabetes mellitus" Diabetes 8,261.
- 15. h. Brinivason and Dharmondra " Neuropathic ulceration leprosy" (Vol. 1) page 224-236.
- 16. Kahitish C Samal. A porojit B. Dey, Biblutib. Tripathi, P Rabiv C., Mehonty Gangadar Misra & Nousingh C. Misra. Cliservations on diabetic foot" from " Diabetes mellitus in developing countries ". pp 242-245.

M.

- 17. Leland S. Mckittrick " Recent advances in the case of the surgical complications of diabetes mellitus " New Eng. J. of Medicine Vol. 235, 1946, 929-932.
- 10. L. Delbridge, M. Appleberg, S.T.S.Re

 "Factors associated with development of foot lesions in the diabetic ". Surg. 93, 1983, No. 1-3, 78-82.
- 19. Nortin C. Rabison & Lee E. Edstrom " The diabetic foot. an alternative approach to major amputation." Symposium on plastic surgery for general surgeon's. pp 1089-1101.
- 20. Activath EJC " Experimental peripheral gangrene effect of cestrogenic substance and its relation to thromboangitis abliterons. Arch intern Hed. 55, 942, 1935.
- 21. Hoore J.M., Fren 1.D.C. (1965). "Peripheral vascular lesions in diabetes mellitus" Brit. Med. J. 2. 19.
- 22. Ookley W. Catteralli, R.C.F. and Mortin M.M. (1956).
 " Aetiology and menagement of lesions of the feet in
 diabetics". Bri. Med. J. 1, 1953.
- 23. Federson J. & Clsen S. (1962). Small vessel disease of the lower extremity in disbetes mellitus in the pathogenesis of foot lesions in disbetes Acts. Med. Scand. 171, 551.
- 24. Fratt 1.0. " Diabetic as a surgical risk ". Bull. New York acad. Med. 26, 786-602, 1950.
- 25. Theodorne C. Fratt. * Gengrene and infection in the diabetic * medical clinics of North America.MCNA. Vol. 49, No. 4, July, 1965.

N.

)N.

- 26. Thomas Mm. "Smoking and vascular surgery " Br. J. Surg. 68, 601-4, 1981.
- 27. Rothmons. " Suspetibility factors in fungus infections in medn " Trans. N.Y. Acad. Sc. 12:27, 1949.

- 28. Robert Cruieshank. J.P. Dugvid. B.P. Marmion & R.H.A. Swain. "Pathogenic fungi", from medical microbiology pp 538-543.
- pathic ulcer and loades on the foot in disbetic patients ". Acts. Orthop. Scand 1975, 46, 839.
- yens and S. Subramanion. "Incidence of Times Fedis among the local population in Madras". Indian J. of Dermatology & venerology LEPA Vol. 46, No. 4, 1980.
- 31. Ainrath L.A. Herzstein J. " Relation of tobacco smoking to arteriosclerosis obliterans in diabetes mellitus. JAMA 131, 205, 1940.

GAUN)